Chemical Bonding and Reactions

PS-4 The student will demonstrate an understanding of chemical reactions and the classifications, structures, and properties of chemical compounds.

PS-4.9 Apply a procedure to balance equations for a simple synthesis or decomposition reaction.

Taxonomy Level: 3.2-C Apply Procedural Knowledge

Key Concepts:
Formulas of substances: subscripts
Balanced equation: coefficients
Synthesis reaction equation
Decomposition reaction equation

Previous/Future knowledge: Students in the 7th grade "explained how a balanced chemical equation supports the law of conservation of matter." (7-5.8)
In Physical Science students will expand concept of balanced chemical equations. Students will write balanced formulas for some ionic compounds. Students will apply a procedure to manipulate coefficients to balance some chemical equations.

It is essential for students to

- Understand that each substance has a formula showing its composition. It is essential to have the correct formula of each substance involved in a reaction before attempting to write a balanced equation.
  - Subscripts are part of the formula for a substance.
  - Subscripts indicate the number of atoms or ions in one chemical unit of that substance.
- Understand that a *balanced equation* represents a chemical reaction that rearranges atoms but does not create or destroy them.
  - For each element, the number of atoms on the reactant side must equal the number of atoms on the product side.
  - C*oefficients* indicate the number of units of each material that is involved in a reaction.
- Understand that subscripts are used to write the formula for a substance; the coefficient in front of the formula is then used to balance the equation after the formulas are written correctly.
- Manipulate only coefficients to balance the atoms in the equation for a simple *synthesis reaction* (two or more reactants combine to form one product) or *decomposition reaction* (a single reactant is broken apart into two or more products).
  - Example of a balanced synthesis reaction equation: (The coefficients are underlined in this example.)

$$\underline{4}\ Al + \underline{3}\ O_2 \rightarrow \underline{2}\ Al_2O_3$$

  - Example of a balanced decomposition reaction equation:

$$2\ NaCl \rightarrow 2\ Na + Cl_2$$

(If the coefficient is one, the number 1 is often not written down, such as Cl_2, and the coefficient is understood to be one.)

It is not essential for students to

- Balance equations other than those for simple synthesis or decomposition reactions.

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Assessment Guidelines:

The objective of this indicator is to *apply* the procedure for balancing a synthesis or a decomposition chemical equation, therefore, the primary focus of assessment should be to know the procedure for balancing the equations and apply it to the situations of balancing simple synthesis and decomposition reactions.

In addition to *apply*, assessment may require students to

- *Recognize* balanced equations;
- *Identify* the number of each type of atom on each side;
- *Recall* that the number of each type of atom will remain the same;
- *Exemplify* synthesis and decomposition equations.